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Community Synergy for Clean Rivers: A Case Study on Household Waste Management in Rural Areas

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Abstract. Effective waste management is a crucial responsibility of the government to protect the environment and public health. Failure in waste management, particularly in densely populated and flood-prone areas, can lead to environmental disasters such as river sedimentation and major flooding. This study aims to analyze the perceptions of the Pungpungan Village community regarding household waste management along the riverbanks and to formulate an ideal and sustainable management strategy. The research method used was descriptive qualitative. The total sample for this study comprised 40 households, which were selected through simple random sampling. In addition, purposive sampling was applied based on specific criteria to select samples according to the community's background and role. The primary data collection techniques in this study included interviews and observations. For secondary data, the research relied on literature reviews and documents, including those from the Pungpungan Village Government Office and library studies. The data analysis in this study employed SWOT analysis. The results indicate that although the community has good knowledge of the 3R concept (reduce, reuse, recycle) and the negative impacts of improper waste disposal, the practice of transforming waste into economically valuable products remains limited. The ideal strategy involves increasing education, providing infrastructure, and enforcing sanitation regulations to achieve sustainable waste management. The implications of this study suggest that a participatory approach, coupled with adequate infrastructure support facilitated by the village government, can significantly enhance the effectiveness of household waste management and encourage more sustainable behavioral changes in rural communities.

Keywords: community behavior; household waste; river; village; waste management

INTRODUCTION

Waste management is a crucial duty of the government in delivering effective public services. This duty encompasses the development and implementation of policies for the efficient and sustainable, collection, sorting, transporting, and processing of waste (David et al., 2020; Olivo et al., 2021; Olukanni & Nwafor, 2019). The government's role is crucial in protecting the environment and public health by ensuring a well-coordinated and effective waste management system is available to all citizens (Grangxabe et al., 2023; Squire & Nkurunziza, 2022; Wang et al., 2020). In this regard, the government must ensure adequate resource allocation and collaborate with the community to achieve better waste management for environmental sustainability and improving community welfare (Irawan et al., 2021; Kurniawan et al., 2022).

A concrete example of the importance of waste management can be observed in the Trutup River, Kalitidu District, Bojonegoro Regency. Several tributaries flowing through densely populated areas in Pungpungan Village face serious issues. In 2019, one of the tributaries overflowed, causing major flooding in the residential area. The Pungpungan Village Government responded by dredging the river in 2020; however, in 2022, the river became silted again. According to the village government, the primary cause of the flooding is the accumulation of waste along the Trutup tributary, which obstructs water flow and causes the river to overflow during the rainy season, especially during heavy rainfall. This emphasizes the importance of effective waste management in preventing environmental disasters such as flooding. Based on this study, there is a gap between the community's knowledge of the importance of waste management and their actual practices. Previous studies indicate that although the community often has a good understanding of waste management concepts and their impact on health and the environment, this

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knowledge does not always translate into significant behavioral changes in daily practices (Brotosusilo et al., 2020; Fadhullah et al., 2022). For example, the residents of Pungpungan Village are aware of the negative impacts of indiscriminate waste disposal, particularly into rivers, and understand the 3R concept (Reduce, Reuse, Recycle). However, their practices do not align with this knowledge, as waste is still frequently disposed of into the river, and waste utilization remains suboptimal.The significance of effective waste management, as demonstrated by the case of the Trutup River in Pungpungan Village, Kalitidu District, Bojonegoro Regency, needs to be taken into account. This serves as a tangible example of the direct impact of waste on the environment and the community's lives. Poor waste management, particularly in densely populated and flood-prone areas, can lead to detrimental consequences such as river siltation and major flooding (Abraham, 2022; Ibrahim & Tasi'u, 2020; Kalafat et al., 2018). These conditions damage the environment and pose a threat to the welfare and safety of the community (Elliott, 2019; Olanrewaju et al., 2019; Wantim et al., 2021). Therefore, proactive government actions and active community participation in waste management are essential to prevent environmental disasters and ensure ecosystem sustainability. Coordinated policies and sufficient resources from the government, along with community awareness and participation, are crucial to maintaining environmental balance and enhancing quality of life (Hoang Tien et al., 2021; Liu et al., 2020; Siregar & Zulkarnain, 2021). Accordingly, this research is necessary as it provides a new perspective on waste management in rural settings, which has often received less attention in terms of community behavior and its impact on the quality of river ecosystems (Mihai et al., 2022; Syafri et al., 2020). Furthermore, this study utilizes a SWOT analysis to identify the internal and external factors influencing waste management, an approach proven effective in formulating integrated environmental strategies (Afshar et al., 2019; Yuan et al., 2020). This highlights the importance of a more integrated strategy that not only focuses on technical aspects but also considers social, economic, and cultural factors in driving sustainable behavioral change within communities (Caferra et al., 2024; Ikram et al., 2022).

Previous research on community participation and river water quality in Bojonegoro have similarities and differences with other research. For example, a study in Makassar on natural resource management based on economic empowerment (Surya et al., 2020), like this study, emphasizes the importance of community participation in environmental management and preservation, particularly in managing natural resources and river water quality. However, this study focuses on household waste management and its impact on river water quality in rural areas, unlike the broader approach in Makassar that includes economic empowerment and natural resource conservation. Meanwhile, this study also resembles the research by Marlia et al., (2022) on community behaviour change along the Martapura riverbanks and Rahmasary et al., (2019) on water, waste, and climate change challenges in Asian cities. Still, it specifically examines the relationship between community participation and river water quality due to waste management, not involving aspects like waste management, drinking water, and the impact of climate change as extensively. Therefore, the novelty of this study provides new insights into environmental management and sustainability in rural areas, offering a unique perspective on the influence of rural community behaviour and their waste management practices on river ecosystems.

The primary focus of this study is to analyze the local community's perception of Pungpungan Village regarding household waste management, especially along the river flow. The research questions explore how the community views and addresses waste issues

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and explore ideal and sustainable waste management strategies that align with their social and environmental context. This study aims to understand the current condition and identify practical solutions that the wider community can adopt to address waste issues effectively and in an environmentally friendly manner. Hence, it researchers with a new understanding of waste management and environmental conservation and enhances insights into sustainable waste management practices in rural environments.

METHODS

The research method used was descriptive qualitative. Descriptive qualitative research, as explained by Bansal et al. (2020), aims to answer questions regarding who, what, where, and how a phenomenon occurs, while also exploring emerging patterns within the phenomenon. Creswell (2008), further elaborates that this approach focuses on understanding social or human issues through in-depth and detailed descriptions presented in words, carried out in natural settings. Sugiyono (2019) mentions that qualitative research is naturalistic, where the researcher acts as the primary instrument to obtain meaningful data, emphasizing a deep understanding of meaning rather than generalization.

This research was conducted in several stages, namely: (1) identifying the problem to be observed, (2) conducting a preliminary survey to determine the sampling location, (3) carrying out field research with sample collection, and (4) analyzing the obtained data, followed by providing research recommendations. This research was based on several theories related to waste management and public perception. According to Law Number 18 of 2008, waste management was defined as a systematic, comprehensive, and sustainable activity that included waste reduction and handling (Siombo, 2022). Public perception in the context of waste management was influenced by internal factors, such as values, attitudes, knowledge, and actions, as well as external factors, like physical and social environmental conditions that shaped specific responses (Widaningsih & Meitriana, 2022). Waste management strategies aimed to improve public health and environmental quality while also turning waste into a resource. One of the approaches mandated in Law No. 18 of 2008 was the 3R concept (Reuse, Reduce, Recycle), which encompassed waste reduction, reuse, and processing waste into new products (Astuti et al., 2020; Lestari et al., 2020).

The population in this research on household waste management strategies among communities along the riverbanks, through the analysis of knowledge, attitudes, availability of facilities, and the role of village officials in Pungpungan Village, Kalitidu Subdistrict, Bojonegoro Regency, consisted of the heads of households in Pungpungan Village who lived near the riverbank, extending from the railway line to the village cemetery, totaling 168 household heads. The population distribution is illustrated in the map in **Figure 1**.

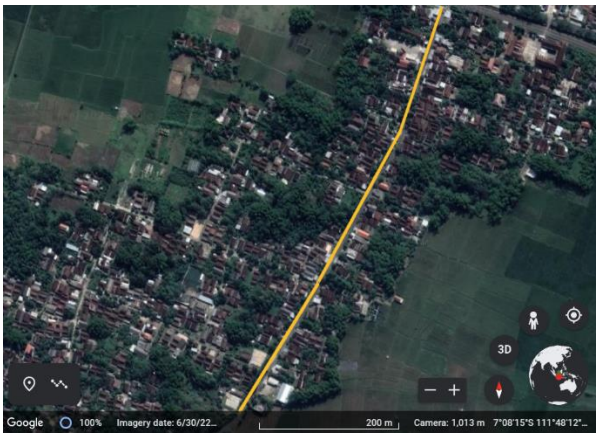

Figure 1. Map of study population area
Source: Village Document of Pungpungan (2023)

The study involved a combination of simple random sampling and purposive sampling. Simple random sampling yielded a sample of 40 households. From classification, 40 purposive samples were obtained, detailed as follows: four neighbourhood leaders from settlements along the river, four residents living right on the riverbank with visible

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waste disposal in the river, four residents living on a clean riverbank without waste disposal, four individuals with outdoor waste disposal facilities, four without such facilities, four village officials, one village head, two members of the Village Consultative Body, two highly educated residents (degree holders), four residents with primary education (elementary, junior high school), five economically disadvantaged individuals, and four well-off individuals. The total sample size calculated was 40 individuals.

In this research, primary data collection techniques included interviews and observations. Interviews were conducted to gather information from residents about their experiences, opinions, and knowledge related to the research topic. Observations were used to study the residents' activities, behaviours, and actions and to get an overview of locations relevant to the research topic. This study relied on a literature review and documents from the Pungpungan Village Government Office for secondary data. The literature review involved analyzing books, articles, journals, and policy reports, while document analysis included the 2022 Pungpungan Village profile document, regional maps, and the 2023 development plan. The research location was Pungpungan Village, Kalitidu Subdistrict, Bojonegoro District, and it was conducted in August 2023.

The data analysis method used to formulate waste management strategies is SWOT, a tool for compiling strategic factors. SWOT analysis helps to describe the external opportunities and threats faced and how these can be aligned with the internal strengths and weaknesses (Rangkuti, 2018). This analysis is applied to household waste management strategies along riverbanks through public perception, also referred to as situation analysis using the SWOT model. The advantages of SWOT analysis in strategic decision-making include: (1) simplicity, which does not require special training or technical skills; (2) collaboration, as it encourages cooperation among managers from various functional areas; (3) flexibility, which can improve the quality of organizational strategy planning even without a marketing information system; and (4) integration, as it can connect to various sources of information (Nurhadi, 2021).

The steps in SWOT analysis according to Sari & Hardianti (2019) include: (1) Identifying internal factors (strengths and weaknesses) and external factors (threats and opportunities). (2) Preparing the IFAS (Internal Strategic Factors Analysis Summary) and EFAS (External Strategic Factors Analysis Summary) tables to analyze the weight, rating, and score of each factor. (3) Determining the weights and ratings for the IFAS and EFAS variables, where the weights are assigned on a scale from 1.0 to 0.0, and ratings are given on a scale from 4 to 1, depending on the influence of the factors. According to Rangkuti (2018), the weight for each factor is assigned from 1.0 (most important) to 0.0 (not important), and the total weight must not exceed a total score of 1.00.

The rating is scored from 4 (outstanding) to 1 (poor), based on the influence of the factor in question. Variables with positive characteristics (all factors categorized as strengths) are given a score from +1 to +4 (very good), comparing the organization's average with its strongest competitor. Meanwhile, variables with negative characteristics are evaluated in the opposite manner. For example, if a weakness is substantial compared to the average, the score is 1, while if it is below average, the score is 4. (4) Calculating the total IFAS and EFAS scores by multiplying the weight by the rating. (5) Determining the (X, Y) axis by finding the Y value by subtracting the total score of strength factors from the total score of weakness factors. Next, the X value is determined by subtracting the total score of opportunity factors from the total score of threat factors (Ahmad, 2020). (6) Applying the results to a SWOT diagram to identify the quadrant position that represents the

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appropriate strategy, ranging from aggressive (Quadrant 1), diversification (Quadrant 2), minimizing weaknesses (Quadrant 3), to defensive strategy (Quadrant 4). (7) Formulating strategies through the SWOT matrix, which consists of four strategic alternatives: (a) Strength-Opportunity (SO), using strengths to exploit opportunities; (b) Strength-Threat (ST), using strengths to address threats; (c) Weakness-Opportunity (WO), exploiting opportunities to minimize weaknesses; and (d) Weakness-Threat (WT), minimizing weaknesses and avoiding threats. **Table 1** presents the SWOT matrix, including internal and external strategic factors and the strategies that can be adopted based on the combination of identified strengths, weaknesses, opportunities, and threats in the SWOT analysis.

Table 1. Matrik SWOT

IFAS (*Internal Strategic Factors Analysis Summary*) EFAS (E*xternal Strategic Factors Analysis Summary*).	**Strength (S) Determine the internal strength factors.**	**Weaknesses (W): Identify internal weaknesses factors.**
Opportunity (O): Identify external opportunity factors.	SO STRATEGY: Create strategies that use strengths to capitalize on opportunities.	WO STRATEGY: Create strategies that address weaknesses to capitalize on opportunities.
Threat (T): Identify the external threat factors.	ST STRATEGY: Develop strategies that utilize strengths to overcome threats.	WT STRATEGY: Create strategies that address weaknesses and avoid threats.

Source: Rangkuti (2018)

RESULTS AND DISCUSSION

The perception of the community along the river flow in Pungpungan Village regarding Household Waste Management

Residents living along the river in Pungpungan Village understand the negative effects of littering, including dumping garbage in the river, on health and the environment. They are also well-informed about waste management through the 3R concept (reduce, reuse, recycle) and aware of waste banks' benefits. This is evidenced by all 40 respondents who understand these issues well. However, residents' knowledge of processing or transforming waste into more valuable products still needs to be improved. Of 40 respondents, 15 need to learn how to convert organic waste into valuable products, and 20 are unaware of how to turn inorganic waste into economically valuable products. The attitude of the residents is unfavourable towards indiscriminate waste disposal, especially in the river, and they dislike pollution in the river. All 40 respondents stated this, and all support the installation of waste collection containers near easily accessible residential areas. They also support having trash bins inside and outside the house, the effort of waste management education by the Village Government, the establishment of waste banks by the Village Government, processing of waste into more useful or economically valuable products, and support the 3R movement. However, behaviorally, some residents still dispose of waste in the river. Many need to practice reuse, as evidenced by 35 out of 40 respondents who dispose of household waste without considering whether it can be reused. They do not practice reduction, as all 40 respondents expressed their intention to reduce waste from activities and household waste. Moreover, they do not recycle, as none of the respondents recycles organic or inorganic waste into other useful or economically valuable products. Many pile up waste outside their homes, with 35 out of

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40 respondents having temporary waste storage on the ground outside their houses, rarely burying it, and instead accumulating it in one place, leading to regular waste burning among 35 respondents.

Household Waste Management Strategy through SWOT Analysis

SWOT analysis systematically identifies various factors to formulate strategies based on the logic that maximizes Strengths and Opportunities while minimizing Weaknesses and Threats. Identifying internal factors, including Strengths and Opportunities, and external factors, including Weaknesses and Threats, in waste management of the community settlements along the river in Pungpungan Village, data is presented obtained through observation and direct interviews with relevant parties regarding strategies that Pungpungan Village Government can use for waste management through community perception.

1) Recapitulation of Internal Factors

In this case, internal factors can be controlled/attempted by the Pungpungan Village Government. Below are the recapitulation results of the internal factors in waste management of the community settlements along the river in Pungpungan Village through community perception, which consists of Strengths and Weaknesses.

a) Strength

The community's strength in Pungpungan Village in managing waste is evident from the extensive knowledge of the residents. All 40 respondents demonstrate a good understanding of waste banks, their benefits, and related activities, even though the village still needs its waste bank. They are also aware of the adverse effects of littering, especially in the river, which leads to diseases, environmental damage, and flooding due to waste blockages in the river flow. This awareness extends to the 3R waste management concept (reduce, reuse, recycle). Furthermore, there is strong support from the Pungpungan Village Government, which is ready to support any strategy to address waste management issues in the settlements along the river.

Table 2. Recapitulation of internal strength factors

	Strength
Strength 1	Residents' knowledge about waste banks
Strength 2	Residents' awareness of the health effects of dumping waste in rivers
Strength 3	Residents' understanding of the environmental impact of disposing waste in rivers.
Strength 4	Residents' knowledge about the 3 Rs (Reduce, Reuse, Recycle).
Strength 5	The presence of support from the village government.

Table 2 shows the internal factors that serve as the main strengths in waste management in Pungpungan Village. The first strength is residents' knowledge about the waste bank, followed by awareness of the health and environmental impacts of improper waste disposal, especially in rivers. Additionally, residents have a good understanding of the 3R concept (reduce, reuse, recycle), which supports sustainable waste management. The fifth factor is active support from the village government, contributing to waste management efforts, particularly in residential areas along the riverbanks.

b) Weakness

The village of Pungpungan faces several challenges in waste management, particularly in residential areas along the river. First, residents have limited knowledge about processing organic and inorganic waste. Fifteen out of forty respondents don't know how to convert organic waste into useful products like fertilizer or fuel, and twenty have inadequate understanding of

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transforming inorganic waste into crafts or other products. Second, the absence of waste disposal sites near the dwellings forces residents to cross busy railway tracks and roads to reach the nearest container. Third, the village apparatus plays a minimal role in educating about waste management; all respondents stated they had never received direct instruction from village officials. Lastly, the lack of specific village regulations on environmental sanitation and management mechanisms, including reward and punishment systems, adds complexity to the issue.

Table 3. Recapitulation of internal weakness factors

	Weakness
Weakness 1	Residents' knowledge on organic waste processing
Weakness 2	Residents' knowledge on inorganic waste processing
Weakness 3	Presence of waste disposal sites near dwellings
Weakness 4	Role of village officials in providing education
Weakness 5	Existence of village regulations

Table 3 shows the internal weaknesses in waste management in Pungpungan Village. The main weaknesses include residents' low awareness of waste processing, both organic and inorganic, resulting in limited utilization of waste into useful products. Additionally, limited access to landfill sites and the minimal role of village officials in providing education on waste management exacerbate the situation. The absence of clear village regulations on environmental sanitation also becomes a barrier, leading to a lack of reward and punishment systems that could encourage residents' participation in maintaining environmental cleanliness.

2) Recapitulation of External Factors

External factors are those beyond the control of Pungpungan village authorities. The recapitulation of external waste management factors in the riverside residential community of Pungpungan through public perception includes both opportunities and threats.

a) Opportunity

Opportunities in Bumbungan village are evident from residents' positive attitudes towards various aspects of waste management. Forty respondents expressed dislike for dumping waste in rivers, indicating high environmental awareness. They fully support easily accessible Temporary Disposal Sites near dwellings to avoid crossing railway lines or roads. This awareness extends to support for waste bins inside and outside homes. Furthermore, respondents back village government initiatives to improve waste management knowledge through education and socialization.

Dislike for river pollution and support for establishing a waste bank by the Pumpungan village government shows awareness of the importance of effective waste management. This is also reflected in their positive attitudes towards converting organic and inorganic waste into more useful and economically valuable products. Lastly, the 3R concept (reduce, reuse, recycle) has full support from the residents, highlighting their commitment to sustainable environmental practices. These attitudes represent significant opportunities for Bumbungan village to develop effective and sustainable waste management strategies.

Table 4 presents various external opportunity factors in Bumbungan Village related to waste management. There are ten factors reflecting residents' positive attitudes toward waste management, ranging from a dislike of dumping waste in rivers to support for the 3R concept (reduce, reuse, recycle). Residents' support for the existence of waste disposal facilities, both inside and outside homes, as well as initiatives to establish waste banks and improve waste processing knowledge, demonstrates a high level of

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environmental awareness. These opportunities can be leveraged to develop more effective and sustainable waste management strategies in the village.

Table 4. Recapitulation of external opportunity factors

	Opportunity
Opportunity 1	Residents' attitudes towards dumping waste in rivers.
Opportunity 2	The residents' attitude towards the presence of a waste collection point in the settlement
Opportunity 3	Residents' attitudes towards having waste bins at home
Opportunity 4	Residents' attitudes towards having waste bins outside the home
Opportunity 5	Residents' attitudes towards knowledge of waste processing
Opportunity 6	Residents' attitudes towards river pollution
Opportunity 7	Residents' attitudes towards the presence of a waste bank
Opportunity 8	Residents' attitudes towards processing organic waste
Opportunity 9	Residents' attitudes towards processing inorganic waste
Opportunity 10	Residents' attitudes towards the 3R concept

b) Threat

Observations in Pungpungan village revealed resident behaviours that threaten effective waste management goals. The primary behaviour is the habit of dumping waste into the river, evidenced by household trash found along the river. Moreover, most of the forty surveyed respondents admit to disposing of household waste without prior sorting, showing a lack of reuse practice. Although all respondents claim good intentions to lessen waste, no significant efforts are observed in terms of reduction. This is also apparent in recycling, where no respondents recycle their waste into valuable products. Regarding landfill systems, most respondents create temporary outdoor waste storage but merely pile it on the ground without further processing. Burning waste is also common, with most respondents regularly burning household trash. Field observations also found increasing volumes of waste in rivers and outside homes, indicating a rise in household waste. The wide variety of waste types demands good sorting processes, which must be practiced more effectively. Lastly, waste bins inside homes are problematic, with most respondents needing more adequate bins. In contrast, outside the home, waste storage does not comply with regulations and merely piles up on the ground.

Table 5. Recapitulation of external threat factors

	Threat
Threat 1	Residents' behavior of dumping waste in rivers
Threat 2	Residents' behavior in reducing waste
Threat 3	Residents' behavior in reusing materials
Threat 4	Residents' behavior in recycling
Threat 5	Residents' behavior in using landfill
Threat 6	Residents' behavior in burning waste
Threat 7	Daily household waste amount
Threat 8	Variety of household waste types
Threat 9	Presence of waste bins inside homes
Threat 10	Presence of waste bins outside homes

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Table 5 summarizes the external threat factors that hinder effective waste management in Pungpungan Village. The main threats include residents' behavior of disposing waste into rivers, a lack of efforts to reduce, reuse, and recycle waste. Additionally, issues related to the landfill system persist, such as the accumulation of waste on land without further processing and the common practice of burning household waste. The diverse quantity and types of waste further complicate waste management, while waste storage facilities both inside and outside homes are considered inadequate and non-compliant with regulations.

3) Scoring of Internal and External Factors

This final step involves scoring internal and external factors in waste management in the riverside residential area of Pungpungan. After gathering internal and external factor data, the next stage is entering this data into weight determination, which reflects the importance of the factor, then rating, which is the quality of the factor, and finally, the score, which is the product of weight and rating. The weighting results form the basis for the IFAS (Internal Factor Analysis Summary) and EFAS (External Factor Analysis Summary) matrices.

Table 6. Internal Factor Analysis Summary (IFAS) Matrix

	Internal Factors	Weight	Rating	Score
S1	Knowledge of residents about waste banks	0.05	3	0.15
S2	Knowledge of residents about the health effects of dumping waste in rivers	0.15	4	0.6
S3	Knowledge of residents about the environmental effects of dumping waste in rivers	0.15	4	0.6
S4	Knowledge of residents about the 3 Rs	0.1	3	0.3
S5	Presence of village government support	0.15	3	0.45
	Subtotal Strength			2.1
W1	Knowledge of residents about organic waste processing	0.1	2	0.2
W2	Knowledge of residents about inorganic waste processing	0.1	2	0.2
W3	The existence of a waste disposal site near residential areas	0.05	2	0.1
W4	Role of village officials in education	0.1	1	0.1
W5	Presence of village regulations	0.05	1	0.05
Subtotal Weakness				0.65
Difference Between Strength and Weakness				1.45

Based on **Table 6**, the summary matrix of the Internal Factor Analysis (IFAS) shows that the total score of strengths in waste management in the Pungpungan riverside residential area reaches 2.1, which is higher than the total score of weaknesses, which is only 0.65. This indicates that the strengths, such as residents' awareness of the health and environmental impacts of waste and the support of the village government, are more dominant than the weaknesses, such as residents' knowledge about organic and inorganic waste processing. The significant difference of 1.45 between the strength and weakness scores suggests that the area has a strong potential to leverage existing strengths in more effective waste management strategies.

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Table 7. Matrix External Factor Analysis Summary (EFAS)

	External Factor	Weight	Rating	Score
O1	Residents' attitude towards littering in rivers	0.07	4	0.27
O2	Residents' attitude towards the presence of waste collection points in settlements	0.02	3	0.07
O3	Residents' attitude towards having garbage bins at home	0.07	3	0.20
O4	Residents' attitude towards having garbage bins outside the home	0.04	3	0.13
.O5	Residents' attitude towards knowledge of waste processing	0.07	3	0.20
O6	Residents' attitude towards river pollution	0.07	4	0.27
O7	Residents' attitude towards the existence of waste banks	0.04	3	0.13
O8	Residents' attitude towards organic waste processing	0.04	3	0.13
O9	Residents' attitude towards inorganic waste processing	0.04	3	0.13
O10	Residents' attitude towards the 3Rs (Reduce, Reuse, Recycle)	0.04	3	0.13
	Subtotal Opportunity			1.67
T1	Residents' behavior in littering rivers	0.07	1	0.07
T2	Residents' behavior in reducing waste	0.07	1	0.07
T3	Residents' behavior in reusing items	0.07	2	0.13
T4	Residents' behavior in recycling	0.07	1	0.07
T5	Residents' behavior in using landfills	0.04	2	0.09
T6	Residents' behavior in burning waste	0.04	1	0.04
T7	Household daily waste generation	0.02	1	0.02
T8	Variety of household waste types	0.02	2	0.04
T9	Presence of garbage bins at home	0.04	1	0.04
T10	Presence of garbage bins outside the home	0.04	2	0.09
Subtotal Threat		1		0.67
Difference Between Opportunity and Threat				1.00

Table 7 provides a summary of the external factor analysis, encompassing opportunities and threats in waste management among communities around river streams. The opportunity factors reflect a positive attitude of residents towards aspects related to waste management, such as knowledge about waste processing and the presence of waste disposal sites, with a total score of 1.67. In contrast, the threats include negative behaviors of residents, such as littering and ineffective waste management, with a total score of 0.67. The difference of 1.00 between opportunities and threats indicates that there are more opportunities than threats in managing waste in the area, providing a strong foundation for improved waste management strategies.

4) SWOT Analysis Quadrant

The total score details of each factor result in a difference of the total score of internal strength and weakness factors being (+) 1.45, whereas the difference of the total score of external opportunity and threat factors is (+) 1.00. Therefore, the Cartesian quadrant diagram of SWOT analysis can be arranged as shown in **Figure 2.**

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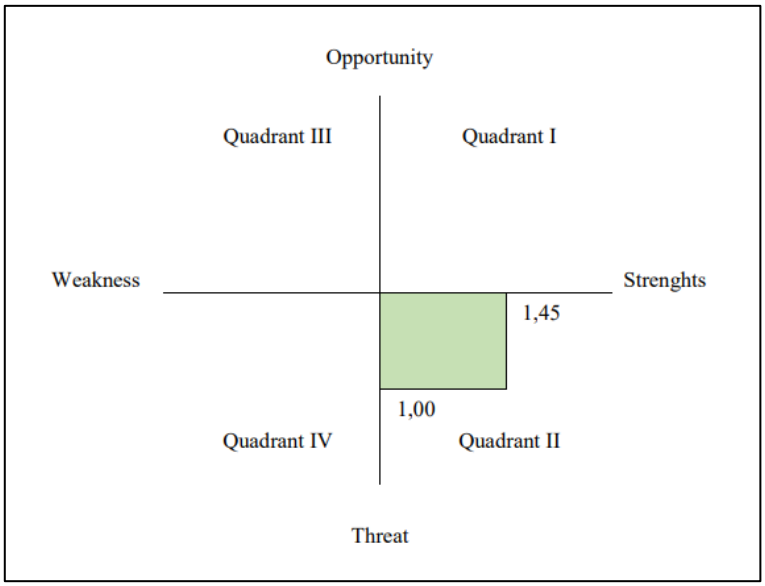

Figure 2. SWOT analysis quadrant

From the diagram in **Figure 2**, the position in quadrant 2 implies the presence of threats but also internal strengths. The main strategy for this position is diversification strategy, using strengths to capitalize on long-term opportunities. Diversification focuses on actions to add new ventures and enhance existing resources.

5) SWOT Analysis Matrix Results

The SWOT Analysis Matrix in Pungpungan Village has become essential in managing waste issues, combining internal and external elements to produce four main strategies. Through the S-O strategy, the village utilizes strengths like residents' knowledge and government support to seize opportunities, including establishing a Waste Bank and creative economic movements from waste processing. The S-T strategy focuses on using the village's internal strengths to face external threats, such as installing prohibition sign boards against littering, providing adequate garbage bins, and rewards for community members contributing to cleanliness. On the other hand, the W-O strategy aims to address the internal weaknesses of the village by leveraging external opportunities. This includes measures like constructing waste disposal sites near settlements, regular counseling by village officials, and punishment for sanitation rule violators. Meanwhile, the W-T strategy focuses on reducing internal weaknesses to avoid external threats, such as improving residents' knowledge of waste processing and installing CCTV in areas prone to illegal dumping. Integrating these four strategies, Pungpungan Village addresses household waste management issues and enhances environmental awareness among its residents, creating a cleaner and more sustainable environment. This comprehensive approach paves the way for the village to be a model for other communities in effectively and responsibly managing waste.

Research on household waste management in Pungpungan Village revealed a complex community perspective. The study found that residents have a good understanding of the negative effects of littering and the concept of 3Rs (reduce, reuse, recycle), yet there is a lack of knowledge about converting waste into valuable products. They also exhibit negative attitudes towards dumping waste in rivers and support the village government's waste management initiatives. However, actual behavior is not fully aligned with this knowledge and attitude, as seen in the habit of dumping waste into rivers and the lack of waste processing practices. A SWOT

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analysis identified strengths, weaknesses, opportunities, and threats in waste management in this village. Strengths include residents' awareness and government support, while weaknesses lie in limited knowledge about waste processing and inadequate infrastructure. Opportunities involve positive attitudes towards various aspects of waste management, whereas threats include irresponsible waste disposal behaviors and insufficient waste sorting.

Household waste management in Pungpungan Village shows that the community has a good awareness of the negative impacts of littering and an understanding of the 3R concept (reduce, reuse, recycle). Among the 40 respondents, all possess knowledge of the concept and its effects on health and the environment. However, their knowledge of processing waste into valuable products remains limited, with only 15 respondents understanding organic waste processing, and only 20 respondents understanding inorganic waste processing. Although residents' attitudes toward waste management initiatives are highly positive, such as supporting waste banks and accessible trash bins, their actual behavior does not entirely align, as littering in rivers and the lack of recycling or reuse practices are still observed. The behavior change theory, as explained by Prochaska and DiClemente in their Stages of Change Model, states that behavior change requires awareness, knowledge, and subsequent action (Szupszynski, 2021). Residents of Pungpungan Village have awareness and knowledge but have not fully moved toward the action stage. Several studies indicate the need for an integrated strategy that not only focuses on the technical aspects of waste management but also considers social, economic, and cultural aspects in promoting behavior change within the community (Awino & Apitz, 2024; Michael Ayorinde Dada et al., 2024).

The SWOT analysis identifies the main strengths as knowledge and government support, with an IFAS score of 2.1, while the weaknesses include limited knowledge and inadequate infrastructure, scoring 0.65 on IFAS. The biggest opportunity is the residents' positive attitude towards waste management (EFAS score of 1.67), while the main threat is irresponsible waste disposal behavior and inadequate sorting (EFAS score of 0.67). The ideal strategy for managing waste in Pungpungan Village includes strengthening education, providing infrastructure, and implementing strict sanitation regulations. Through a diversification strategy, the village can leverage its strengths and opportunities to create more effective and sustainable waste management. This approach aligns with several studies that show that integrating technology and participatory education can enhance sustainable waste management efforts, increase awareness, and foster collective responsibility among residents to maintain the cleanliness of the river environment (He et al., 2024; Oktarini et al., 2023). This emphasizes the importance of the village government's role as the main facilitator in creating a sustainable waste management system and how community-based education programs can significantly improve residents' pro-environmental behavior. Therefore, the integration of community-based strategies and infrastructure support can strengthen the success of sustainable waste management programs in Pungpungan Village.

Referring to previous research on community behavior in waste management, Marlia et al. (2022) focused more on behavior change among riverbank communities in Martapura regarding river management due to local government policies. Marlia's study highlighted community adaptation to river management policies, while this study emphasizes overall waste management behavior and practices, including aspects of infrastructure support and community-based education. Nevertheless, Marlia's study supports this research's findings as both stress the importance of behavior change as a key element in better environmental

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management efforts. Meanwhile, Rahmasary et al., (2019) which highlights challenges in water, waste, and climate change management in Asian cities, provides a relevant perspective on broader waste management in urban contexts. This research reinforces the finding that effective waste management requires an integrated strategy that focuses not only on technical aspects but also on social and economic factors, and emphasizes the importance of community involvement. While the study focuses on large urban areas in Asia, it supports this study, particularly in terms of the importance of community capacity building and cross-sectoral integration for more sustainable management. On the other hand, Surya et al. (2020) in Makassar highlight the importance of natural resource conservation through economic empowerment in watershed and slum area management. In this study, the positive impact of conservation based on community economic empowerment also supports the concept of the proposed diversification strategy. Surya's study demonstrates that integrating environmental conservation with economic empowerment can enhance ecosystem sustainability, which is relevant to the waste management efforts in Pungpungan Village.

Thus, the advantage of this study compared to previous research lies in its more specific approach to assessing community behavior towards waste management at the village level and the SWOT-based strategy analysis that offers integrated solutions, including strengthening education and providing infrastructure. The novelty of this study is in the application of community-based strategies for more effective waste management, with a focus on promoting concrete actions among the community, rather than just awareness or knowledge. This study emphasizes the importance of participatory approaches and the support of the village government as the main facilitator to create a sustainable waste management system, thereby making a significant contribution to the development of more community-based environmental management strategies in Indonesia.

CONCLUSION

This study reveals that while Pungpungan Village residents are aware of the adverse effects of littering and the importance of the 3R concept (Reduce, Reuse, Recycle), a gap remains between their knowledge and practices, particularly in transforming waste into valuable products. The main strengths identified are community awareness and support from the village government, whereas weaknesses include limited technical knowledge in waste processing and inadequate infrastructure. Opportunities lie in the positive attitude of residents towards waste management, while the primary threats are habitual littering and inadequate waste sorting. Through SWOT analysis, the study recommends an integrated strategy that includes establishing a waste bank, providing temporary disposal facilities, conducting educational and training programs, and fostering community participation via technology and diversification approaches. This strategy strengthens the village government's role as the facilitator of sustainable environmental management. The study emphasizes the necessity of an integrated approach, involving collaboration among the village government, community, and private sector to create facilities, offer waste-processing training, and promote participatory education, aiming to drive effective behavioral changes and enhance environmental quality along the river. This model provides a sustainable solution that can be adapted by other regions facing similar waste management challenges.

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